Determinants of Chestnut demanded quantities: an empirical estimation using panel data

PAULO REIS MOURÃO*, TERESA MOURÃO**

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Abstract

In this work, we studied the economic determinants of chestnut demanded quantities. We conclude by stating that chestnuts are only demanded in countries with a traditional presence of this product in people's diets, taking up strong challenges deriving from the globalisation process. We have also found a significant dependence of chestnut demanded quantities on real income per capita. Price effects were concluded as not influencing CDQ in the panel estimations.

Key-words: Chestnuts; Demand; Determinants; Panel data.

Résumé

Dans le présent travail, nous avons évalué les déterminants économiques de la demande de châtaignes. Nous avons démontré que les châtaignes sont demandées exclusivement par les pays où, traditionnellement, le régime alimentaire inclut la consommation de ce fruit et sur lesquels pèse actuellement le défi de la mondialisation. En plus, nous avons déterminé que la demande de châtaignes dépend d'une manière significative du revenu réel par habitant. Enfin, compte tenu des données fournies par un panel d'experts, nous avons conclu que l' effet du prix n'influe nullement sur la demande de châtaignes.

***Mots-clés**: Châtaignes, Demande, Déterminants, Donnée du Panel.*

1. Introduction

The role of own-price and consumer income in chestnut demanded quantities (CDQ) have been often documented in national accounting frameworks, but there are very few cross-country comparisons between CDQ determinants emphasizing the role of economic factors and the mixed impact deriving from the presence of Other Agropecuary Related Products (OARP). The most cited OARP are pork (whose gastronomic preparation often includes chestnuts), almonds, dry beans and wheat (as complementary sources of carbohydrates), nuts and potatoes (as usual substitute commodities), and apples, oranges, peaches and strawberries (as seasonally consumed fruits, they are usually used to infer the influence of the persistence of warm weather, *i.e.* people who are used to eat chestnuts in autumn and winter, are also used to consume some of the above-mentioned summer fruits during the remaining seasons, indicating the existance of a relationship of seasonal complementarily)[1]. Therefore, once estimated, the impacts of these OARP on CDQ should be clearly positive for pork, clearly negative for nuts and potatoes, and not precisely defined for the remaining commodities (mainly depending on the national consumption habits).

The (hypothesizable) non-significance of the influence of consumer income or own-price on CDQ is often linked to the assumption of the non elasticity of the chestnut demand function induced by historical dietary habits, especially in the Mediterranean rural areas (Fidanza, 2002; Smith *et al.*, 2004). Econometric studies on this hypothesis are however scarce.

This article built on FAO (Food and Agriculture Organization of the United Nations) cross-country data on potential CDQ determinants resorts to an extended panel of 13 countries[2] (accounting for 95.9% of the 2004 chestnut market) and to the use of the generalized method of moments (GMM), which allows some determinants to have a diffusion effect on CDQ.

This article concludes by stating that chestnuts are only demanded in countries characterized by the traditional presence of this product in people's diet, taking up strong challenges deriving from the globalisation process, with a significant dependence on real income per capita. Price effects were observed as not being able to influence CDQ in the panel estimations.

2. Determinants of Chestnut demanded quantities – a discussion

This study[3] is seeking to identify the main determinants of CDQ. The baseline equation that is estimated follows:

$$\Delta CDQ_{i,t} = \alpha.\Delta CDQ_{i,t-1} + \beta.Det_{i,t} + u_i + \eta_t + \varepsilon_{i,t}$$

* Department of Economics of the University of Minho, Gualtar, 4700 Braga, Portugal.
** Instituto de Emprego e Formação Profissional, Vila Real, Portugal.

[1] The rationale behind this choice is detailed in reports from the "FOOD PROCESSING CENTER INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES UNIVERSITY OF NEBRASKA – LINCOLN, 2002" and from Gold, Cernusca and Godsey (2005).

[2] In alphabetical order, Bolivia [3%], China [71%], France [2%], Greece [1%], Hungary [0.3%], Italy [3%], Japan [4.1%], (South) Korea [3.5%], Portugal [2.3%], Russia [1.7%], Serbia and Montenegro [0.1%], Spain [0.3%] and Turkey [3.7%]. Between square brackets, the national proportion of aggregate CDQ, using FAOSTAT (2006), category 'Food quantity – tons'.

[3] Data deriving from FAOSTAT (2006), available in http://faostat.fao.org/site/336/default.aspx, and *Penn World Table – PWT 6.2*, developed by Heston, Summers and Aten (2006), available in http://pwt.econ.upenn.edu/php_site/pwt62/pwt62_form.php.

where $i=1...N$ (N is the number of countries, 13 as already stated) and $t=1990,1991,...,2004$; is a raw-vector of l coefficients for the l determinants (the suggested OARP plus the real income per capita and the level of economy openness[4]) and is a column-vector taking the observation for each l determinant from the i-country at the t-year. Δ-$CDQ_{i,t-1}$ is the log difference of CDQ. All the variables are in logs. The usual country-specific effect, u, is included. is a time dummy. is a disturbance.

Table 1 – *Estimations of CDQ determinants [n = 13; t = 1990,...,2004; N_obs = 83]*

	Fixed-effects	Random-effects	GMM
Autoregressive term, $\Delta CDQ_{i,t-1}$			0.505*** (0.059)
Almonds	-0.115 (0.095)	-0.079 (0.129)	-0.056 (0.059)
Dry beans	-0.249 (0.212)	0.482** (0.162)	-0.393*** (0.167)
Nuts	0.129*** (0.048)	0,049 (0.085)	0.084 (0.059)
Oranges	0.372** (0.145)	-0.312 (0.285)	0.265** (0.123)
Peaches	0.259 (0.178)	0,396** (0.189)	0.103 (0.108)
Pork	-0.684 (0.547)	-2.712*** (0.289)	-0.051 (0.338)
Potatoes	0.484 (0.325)	0.612** (0.208)	0.075 (0.120)
Strawberries	0.169 (0.113)	0.006 (0.111)	0.001 (0.078)
Wheat	1.543*** (0.504)	0.090 (0.443)	0.813** (0.339)
Real Income per capita	0.762** (0.311)	0.210 (0.222)	1.041** (0.309)
Openness	-0.786*** (0.205)	1.450*** (0.207)	-0.523*** (0.108)
Chestnuts (own-price)	-0.045 (0.142)	0.028 (0.246)	0.028 (0.077)
	Sigma_u: 1.593 Sigma_e: 0.226 Rho: 0.980 F(12.61)=5.53***	Sigma_u: 0.000 Sigma_e: 0.226 Rho: 0.000 Wald(12)=276.3***	P-value (Arellano-Bond test, no autocorrelation, order 1): 0.0526
			P-value (Arellano-Bond test, no autocorrelation, order 2): 0.9289

The fixed effects regression is the model to use when a researcher wants to control the omitted variables that differ from case to case but that are constant in time. This model lets him use the changes in the variables over time to estimate the effects of the independent variables on the dependent variable (and it is the main technique used for the analysis of panel data).

The fixed-effects results appear in the first column of Table 1. According to these findings, we must to notice the positive influence of nuts and orange demanded quantities (0.129 and 0.372). The real income per capita has also a positive impact on CDQ (0.762) and the openness puts into evidence a negative influence on CDQ (-0.786).

If the research team has reason to believe that some omitted variables may be constant over time but vary from case to case, and others may be fixed from case to case but vary over time, then it can include both types by using random effects.

The random-effects findings are shown in the second column of Table 1. Actually, they significantly differ from the fixed-effects results. Firstly, they indicate different and significant influences by dry beans (0.482) and openness (1.450). Secondly, they find significance in the estimated coefficients for peaches (0.396), pork (-2.712), and potatoes (0.612). Thirdly, they pinpoint the loss of significance of wheat and real income per capita.

However, the generally accepted way of choosing between fixed and random effects is by carrying out a Hausman test. Statistically, fixed-effects are always a reasonable thing to do with panel data (they always give origin to consistent results) but they may not represent the most efficient model to follow. Random- effects will result in better p-values (as noticed in this case) because they are a more efficient estimator. The Hausman test assesses the null hypothesis that the coefficients estimated by the efficient random-effects estimator are the same as the ones estimated by the consistent fixed-effects estimator. In this case, they are not the same because we obtained a significant p-value (chi-square of 250.24, with a null probability, prob>chi-square=0.00). Therefore, we have to carefully pay attention to fixed-effects results and not to value the random-effects values.

Finally, given the small n (n=13) and the small t (t=15), some characteristics of the fixed-effects estimator must be underlined. According to Arellano and Bond (1991), there are various sources of bias in the fixed effects model, especially due to the correlation of the lagged dependent variable and to the eventual small dimension of n and of t. Therefore, their final suggestion is to make an estimate by using the G-MM method because a more efficient estimator results from the use of additional instruments whose validity is based on orthogonality between lagged values of the dependent variable and the errors.

The GMM findings, presented in the third column of Table 1, confirm the marked influence of some OARP on CDQ, namely dry beans (a significant consumption rival),

[4] CDQ and OARP units are (the logs of) 'Food quantity/day/capita – grams'. The real income per capita and the openness data were taken from the cited source *Penn World Table – PWT 6.2*.

oranges (a summer fruit particularly consumed in the Mediterranean basin and in Asia, revealing again the importance of cultural patterns) and wheat. Remarkably, the real income per capita has a positive impact on CDQ. The estimated coefficient signifies that a rising of 1% in the income per capita may induce an increase of 1.04% of CDQ[5].

This result is very noticeable because it indicates that CDQ are now being highly influenced by the standard of life of modern populations: if, in most cases, chestnuts have been incorporated in rural diets, today, we only can actually expect CDQ to increase only if people income rises as well. Another very interesting observaton is that the coefficient of own-price is not characterized by a significant value, which induces an inelastic demand through the panel. Therefore, the consumption of chestnuts tends to replicate the past patterns, strengthened by the magnitude (and the significance) of the autoregressive term (0.51) and by the negative and significant coefficient of the openness of each country. CDQ are highly depending on traditional diet habits, and if new imported nuts commodities arrive, they can be easily seen as preferable chestnut substitutes.

3. Conclusion

In this work, we have studied the economic determinants of chestnut demanded quantities. Our estimates suggest a possibility of positive influences from oranges and wheat, being oranges a seasonally consumed fruits, usually used to infer the influence of the persistence of warm weather, and wheat a complementary source of carbohydrates. The main consumption rival is represented by dry beans. The real income per capita has a positive impact, contrasting with the non-significance of price estimates, and promotes the final conclusion that, facing the modern urban consumption patterns, chestnuts are actually demanded only in countries characterized by the tradtional presence of this product in people's diets, tsking up strong challenges deriving from the globalisation process.

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[5] Looking at the (non-significant) coefficient of chestnut own-price (0.028), that is an interesting positive value, and combining it with the strong influence of the income factor, we could wrongly conclude that chestnuts are a *giffen good* . However, this relevant non-significance shows that the chestnut demand is inelastic and that quantities do not vary because of price changes.